

ORTHOPAEDIC TUMOURS



DJM FRANTZEN

PRINCIPLES



STAGING

WORKUP

RADIOLOGY

BIOPSY

PROCEDURES

CHEMOTHERAPY

RADIOTHERAPY

STAGING

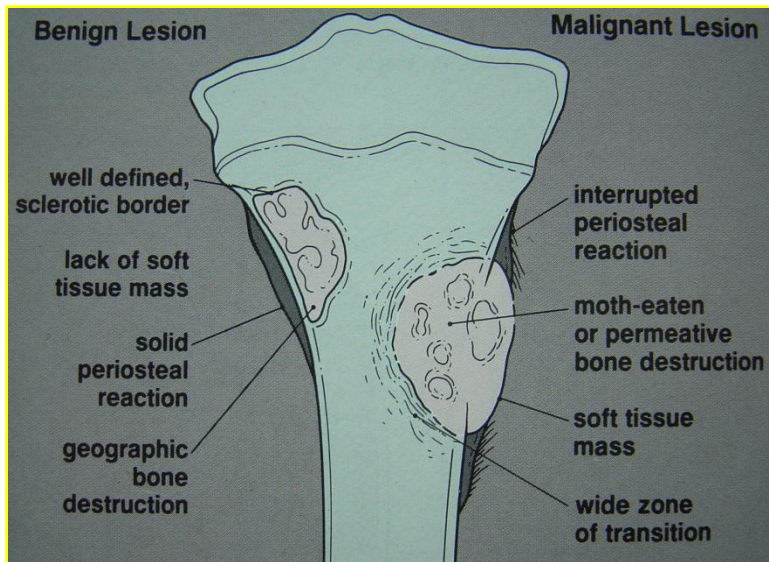
(ENNEKING)

ENNEKING'S SURGICAL STAGES			
STAGE	GRADE	SITE	METASTASES
1A	Low(G1)	Intracompartmental(T1)	None(M0)
1B	Low(G1)	Extracompartmental(T2)	None(M0)
2A	High(G2)	Intracompartmental(T1)	None(M0)
2B	High(G2)	Extracompartmental(T2)	None(M0)
3	Low(G1) or High(G2)	Intracompartmental(T1) or Extracompartmental(T2)	Yes(M1)

GRADING

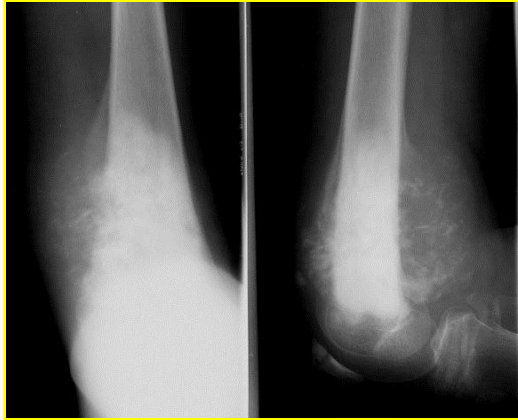
- **G0= Histologically benign** (well differentiated and low cell to matrix ratio)
- **G1= Low grade malignant** (few mitoses, moderate differentiation and local spread only)
- **G3= High grade malignant** (frequent mitoses, poorly differentiated, high risk for metastases)

Features of aggressive tumours



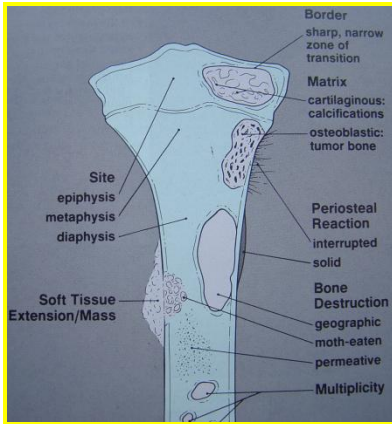
- Cellular atypia
- Frequent mitoses
- Extensive necroses
- Significant vascularity
- Small amounts of immature matrix

EXAMPLES



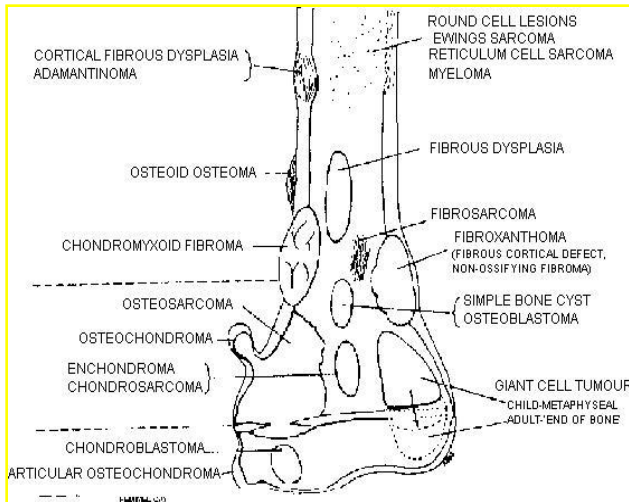
LOW (G1)	HIGH (G2)
Parosteal osteosarcoma	Classic osteosarcoma
Secondary osteosarcoma	Primary osteosarcoma
Myxoid liposarcoma	Pleomorphic liposarcoma

SITE



- T1 = INTRA-COMPARTMENTAL

- T2 = EXTRA-COMPARTMENTAL



Intracompartmental

intraosseous

intra-articular

Intrafascial compartments:

- ray of hand or foot
- posterior or anterior leg
- ant, med, post thigh
- buttocks
- volar or dorsal forearm
- anterior or posterior arm
- pericapsular

Extracompartmental

soft tissue extension

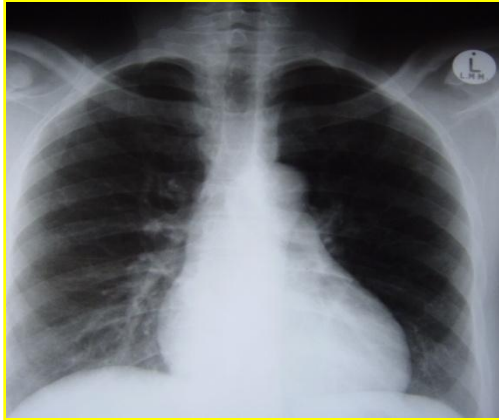
deep fascial extension

Extrafascial planes/spaces: (neurovascular containing spaces)

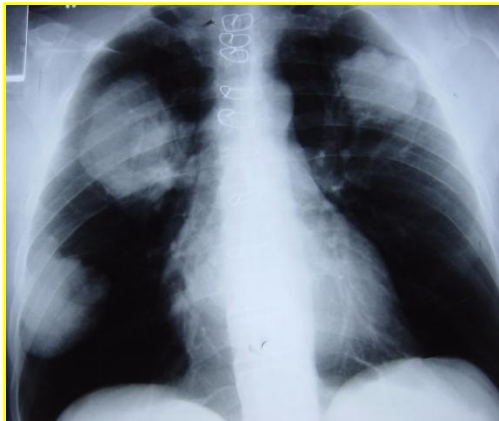
- mid & hind foot / mid hand
- popliteal fossa
- groin-femoral triangle
- intra-pelvic
- antecubital fossa
- axilla
- paraspinal

METASTASES

(Nodal or bloodborn spread)



- MO = No evidence of regional or distant metastases



- M1 = Regional or distant metastases present

TUMOUR WORKUP

- Clinical examination
- Bloods
- Urinalysis
- CXR
- Abdominal sonar
- Bonescan
- MRI
- CT (lesion/chest)
- Angiography
- Biopsy

CLINICAL EXAMINATION

(age,sex,site,past history)

- Breasts
- Thyroid
- Chest
- Liver
- Kidney
- Rectal

AGE



VS



- Probability of OS in 12-25 yrs

- Mets in > 50 yrs

- Chondroblastoma vs GCT

10-20 yrs vs 17-30 yrs

ROUND CELL TUMOURS

- < 6 YRS : Metastatic neuroblastoma
- 6-15 yrs : Single lesion = Ewing's
Multiples = Lymphoma / Leukaemia
- 15-35 yrs : Lymphoma / Leukaemia
- > 35 yrs : Myeloma / Lymphoma / Metastatic melanoma

HISTORY

- Presenting complaint
- Pain and / or swelling
- Character / duration of symptoms
(distinguish benign / malignant clinically)
- Past and family history
- Loss of weight
- Other

PHYSICAL EXAMINATION

- General health
- Anemia , wasting , spleen ?
- Skin lesions
- Precocious puberty
- Hypogonadism
- Optical abnormalities
- Exophthalmos (EG , FD)

LOCAL EXAMINATION

- Location (epi , meta , diaphysis)
- Tumor size
- Consistency (bone or soft tissue)
- Fixed or mobile
- Solitary or multiple
- N/V status
- Lymph nodes ?

LABORATORY

- Blood / urine samples seldom helpful
- Multiple myeloma
- Metastatic disease
- Pagets
- Infection

LABORATORY examinations

- FBC
- ESR
- Biochemistry
- Acid-phosphatase
- PSA
- Thyroid function test
- Serum protein electrophoresis

ALKALINE PHOSPHATASE

- ELEVATED IN ANY ENTITY WITH OSTEOLYTIC ACTIVITY
- BONEFORMING OS
- BLASTIC METS
- PAGETS
- ETC

NEUTROPHILIA

- Osteomyelitis , sometimes Ewing's sarcoma

ESR

- ELEVATED IN :

INFECTION

EOSINOPHILIC GRANULOMA

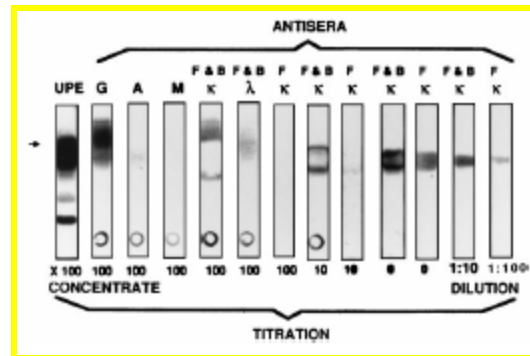
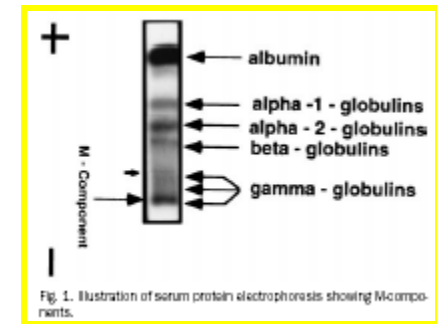
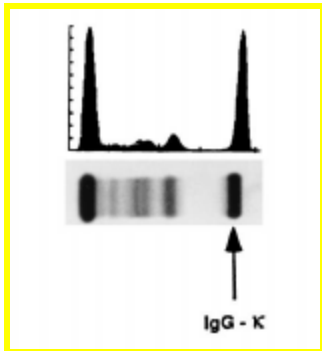
MYELOMA

ANEMIA

- LYMPHOMA / LEUKEMIA
- CHRONIC DISEASE
- EWINGS
- ETC

PROTEIN ELECTROPHORESIS

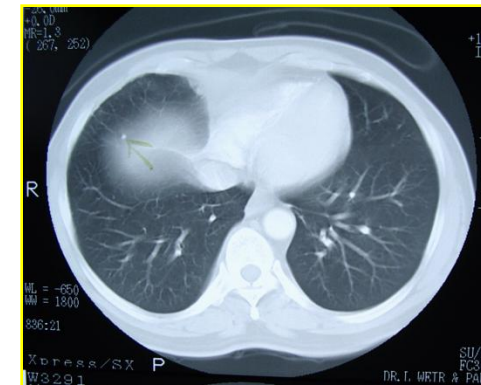
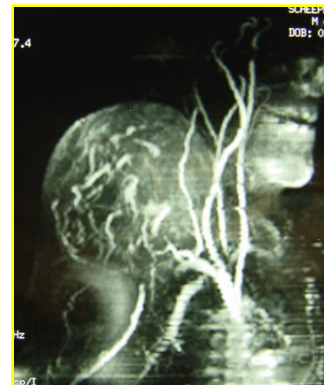
- MYELOMA



RADIOLOGICAL EXAMINATIONS



- Tc 99
- CT-scans
- Angiography
- MRI



RADIOGRAPHIC INTERPRETATION

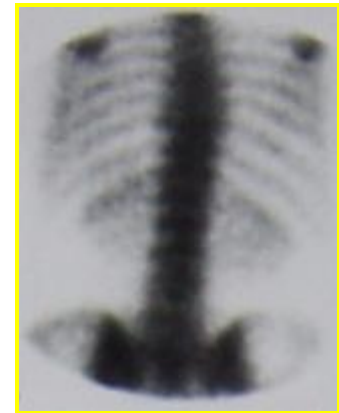
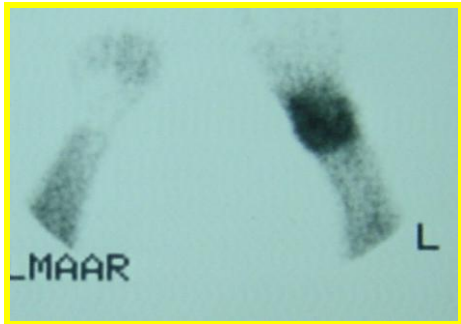


- X-RAYS IN 2 PLANES
- CT : BONE FORMATION ,
CALCIFIED LESIONS
INTEGRITY
CORTEX
LUNG METS



Tc- BONESCAN :

- - Detects skeletal mets
- - presence of multiple lesions ,
enchondromas ,
osteochondromas ,etc.
- May be false negative in
multiple myeloma



MRI

- STUDY of choice to determine anatomical setting of both bone and soft tissue tumors
- Tumour relationship to vital structures like blood vessels and nerves
- Evaluation of lesion on Tc scan, not yet visible on X-rays

ULTRASOUND

- FOR SYSTIC LESIONS /
- SOFT TISSUE MASS

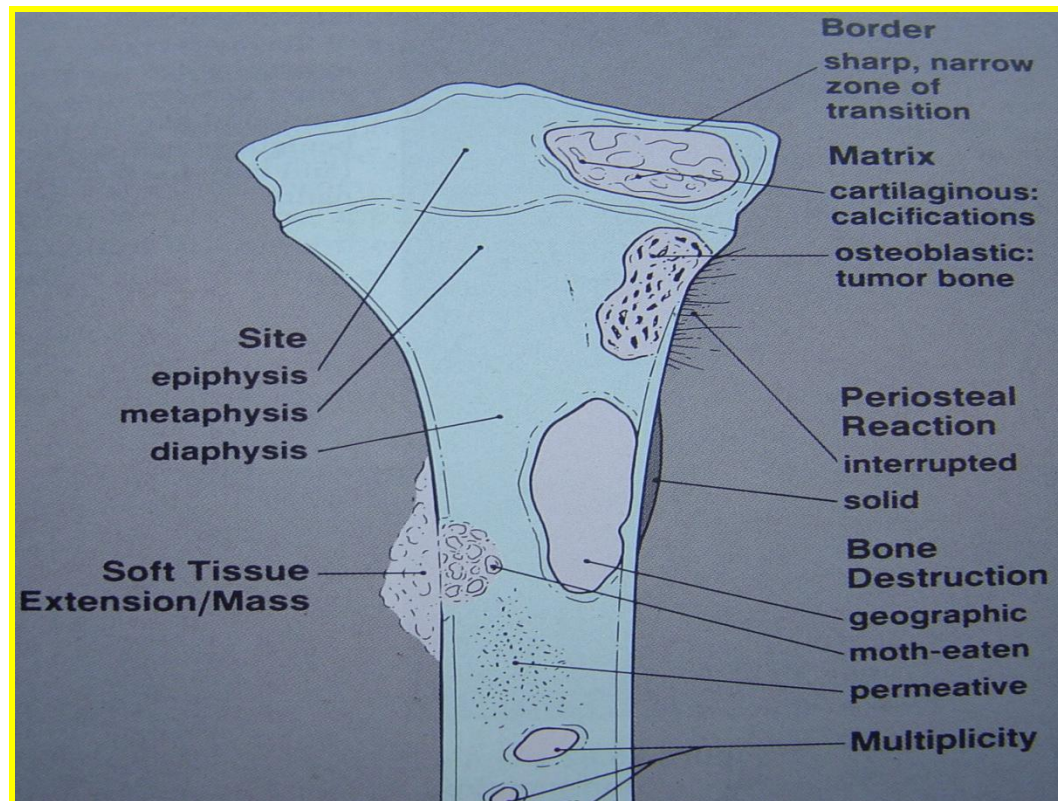
ARTERIOGRAPHY



- SELDOM USED
- EMBOLIZATION OF APPROPRIATE LESIONS

RADIOGRAPHIC FEATURES

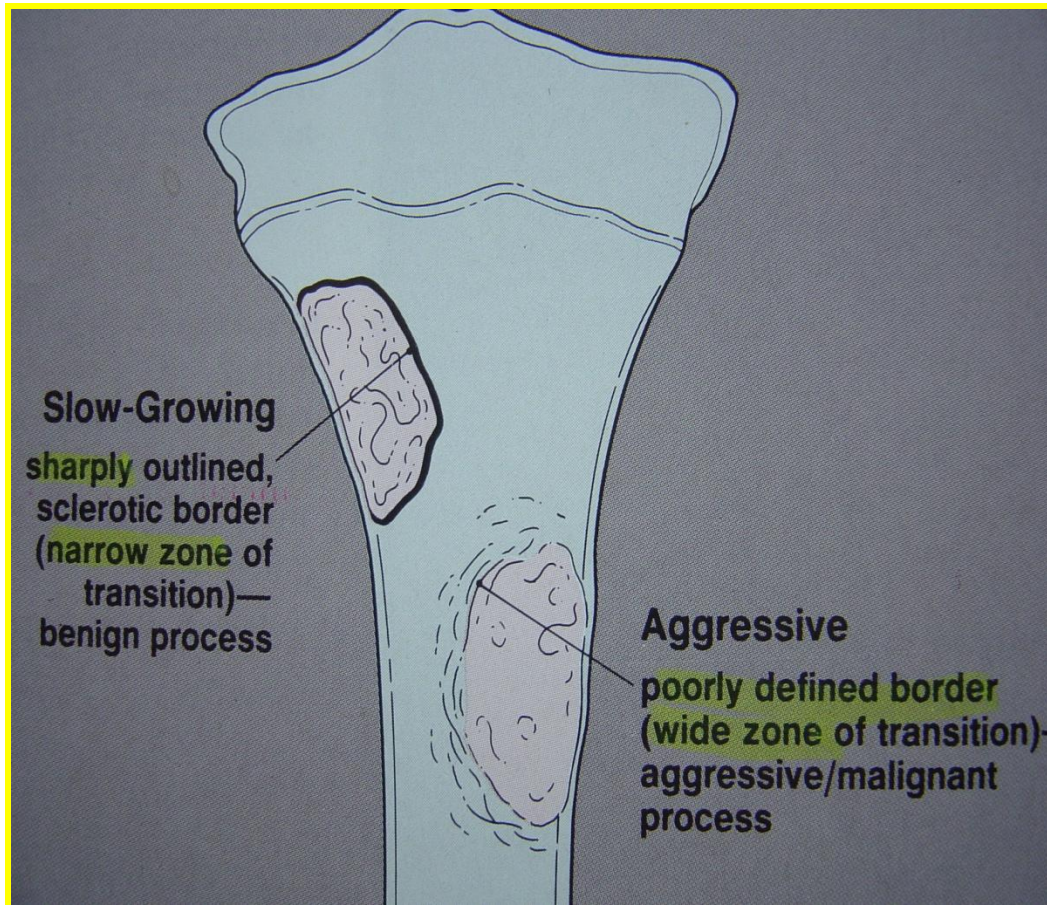
TUMORS AND TUMOR- LIKE LESIONS OF BONE



SITE

- Epiphysis : GCT , Chondroblastoma
- Metaphysis : Osteosarcoma, osteoblastoma,
Chondromyxoid fibroma, NOF
osteochondroma
- Diaphysis : Metastatic carcinoma ,Ewing's ,
Chondrosarcoma

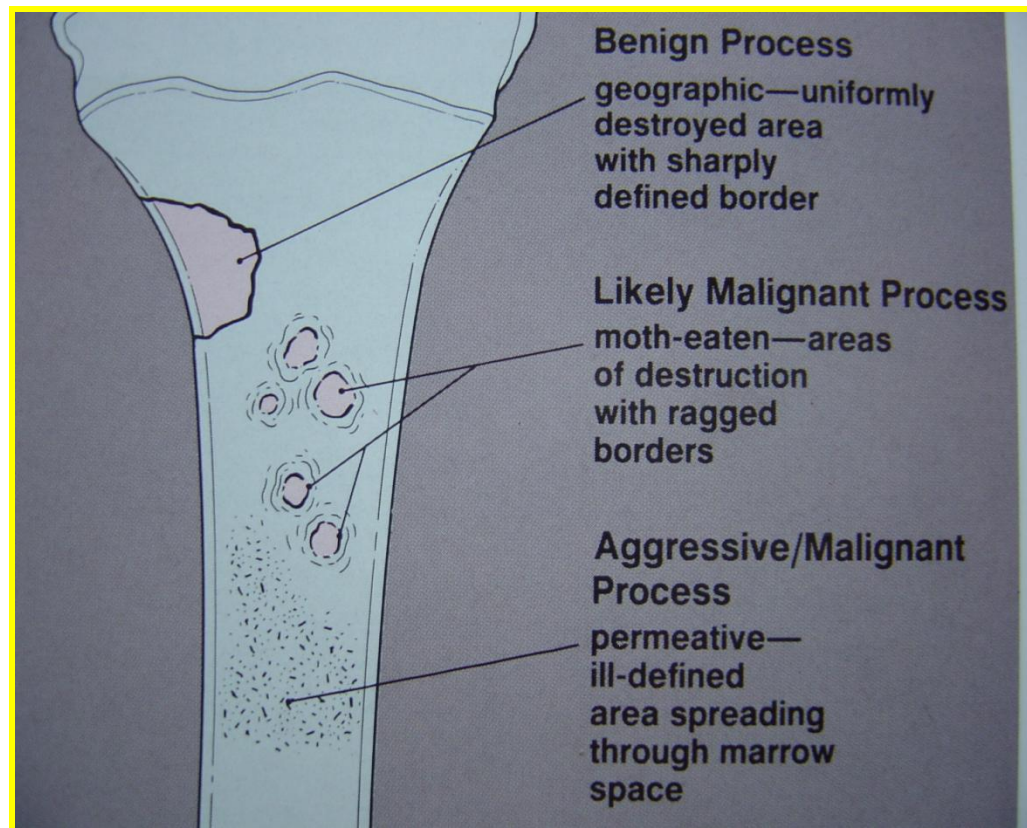
RADIOGRAPHIC FEATURES



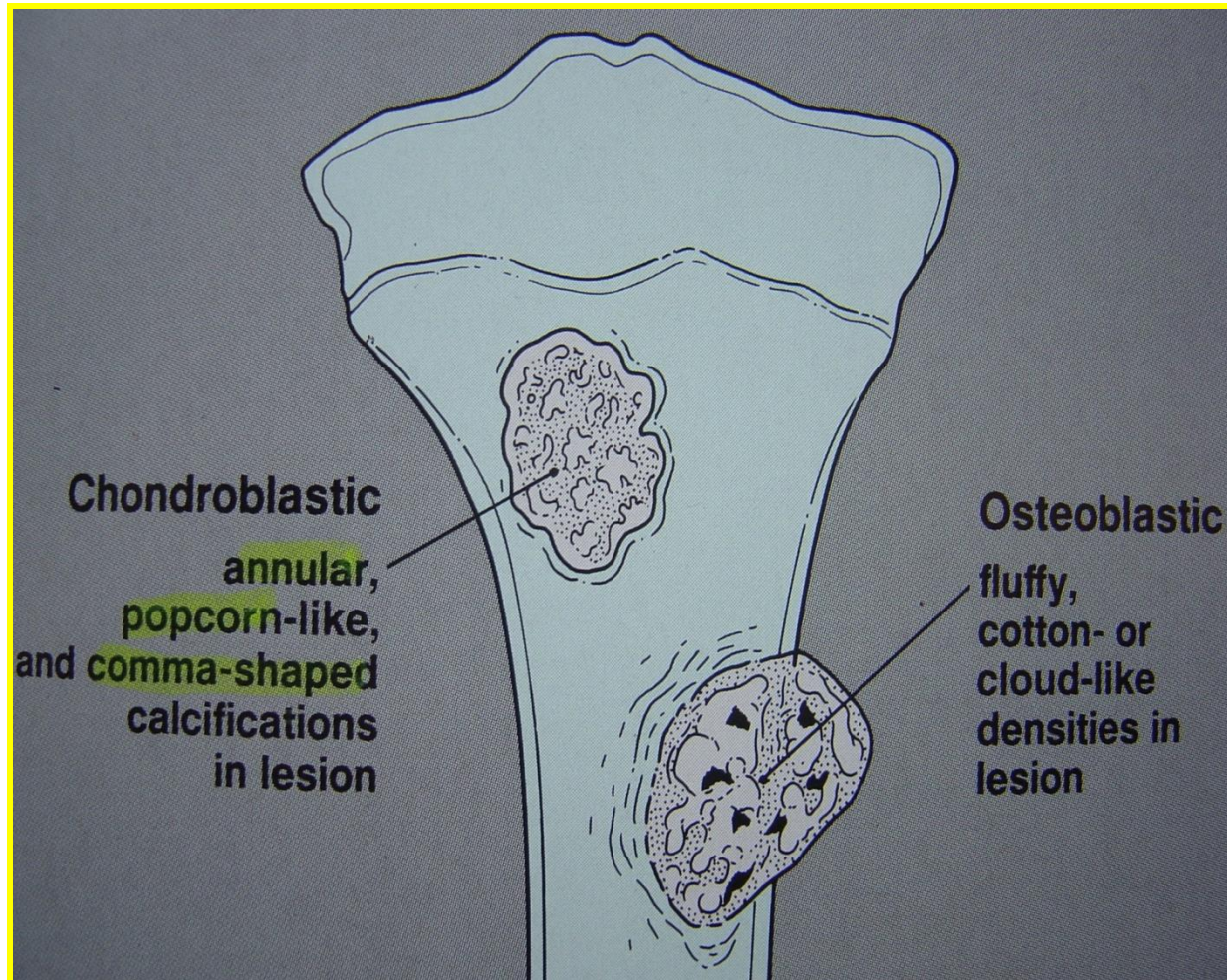
- BORDERS
- - SLOW GROWING .. BENIGN
- - AGGRESSIVE .. MALIGNANT

TYPE OF BONY DESTRUCTION

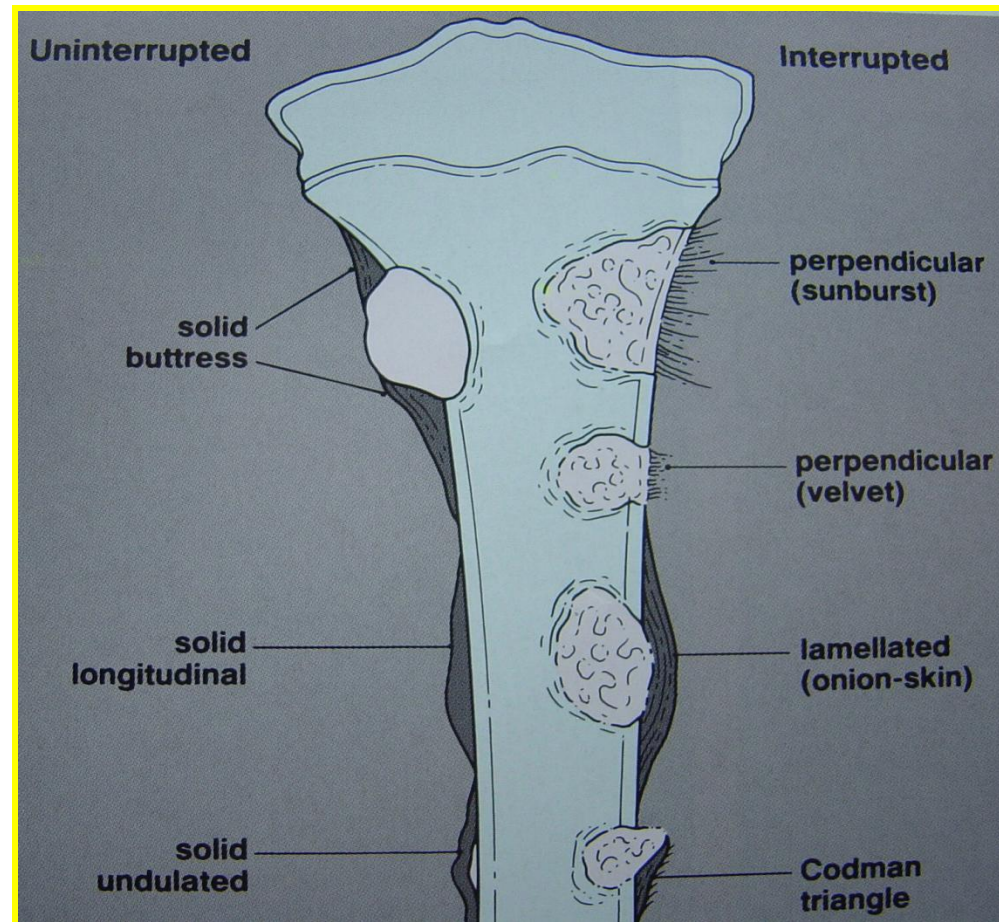
RADIOGRAPHIC FEATURES




CARTILAGE VS BONE



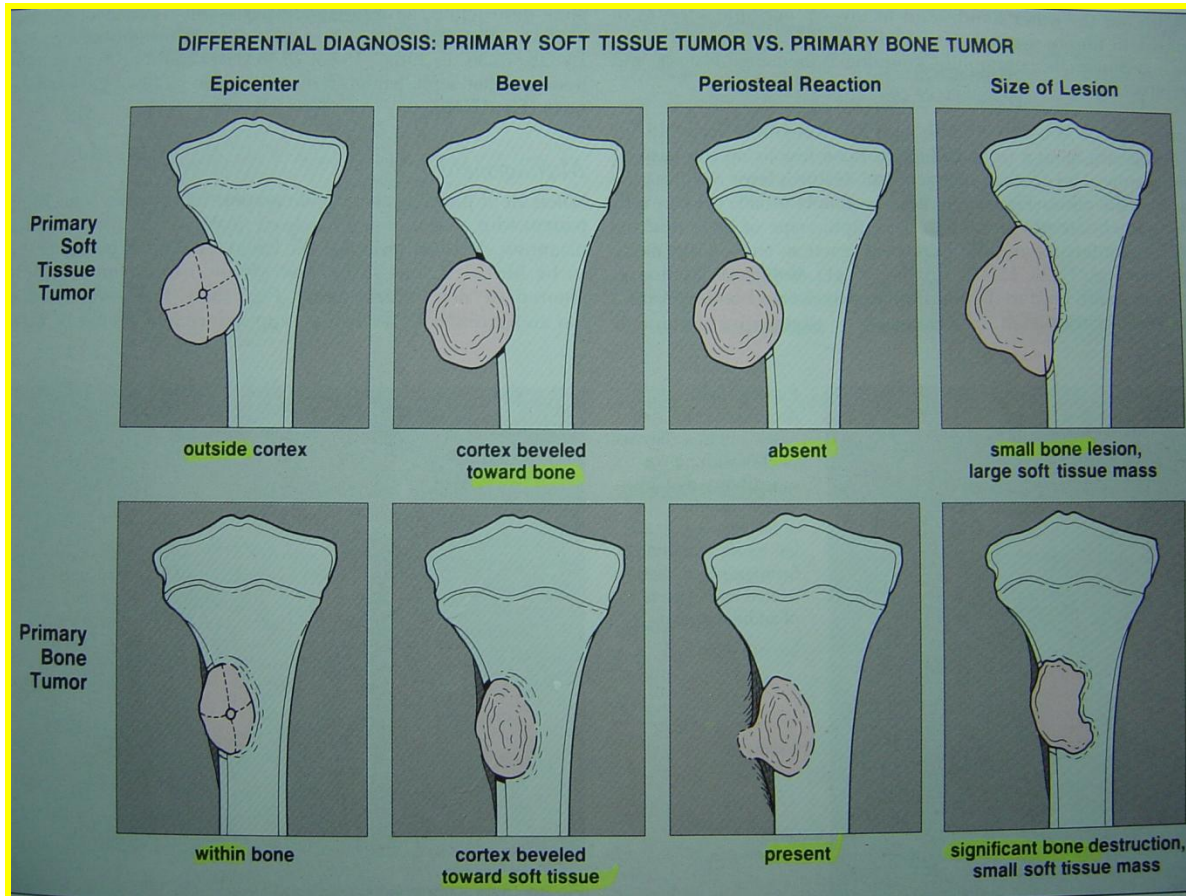
PERIOSTEAL REACTION



PERIOSTEAL REACTIONS

- Codman : Triangular cuff of reactive periosteal bone at the edge of a lesion. (OS, osteomyelitis, ABC, infection)
- Onion-skinning : Due to episodic or pulsatile tumour growth (Ewing's , Infection, OS of shaft)
- Sunburst : Rapid continuous periosteal lifting and stretching (bone next to Sharpy fibres)

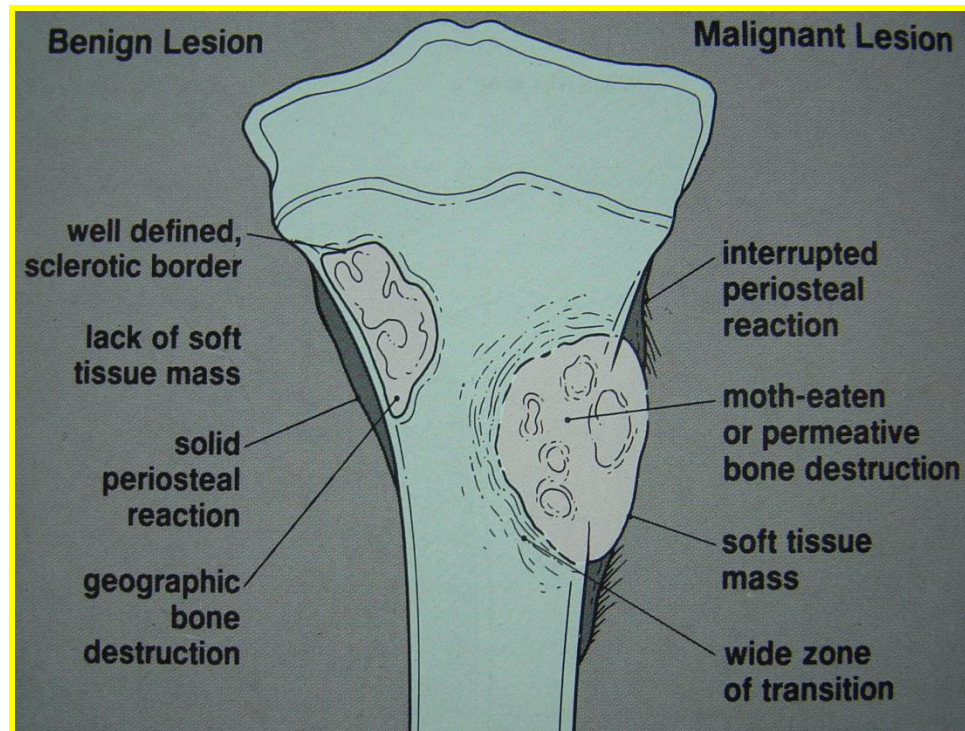
SOFT TISSUE INVOLVEMENT



PRIMARY
SOFT TISSUE
TUMOUR
VS
PRIMARY
BONE
TUMOUR

RADIOGRAPHIC FEATURES

BENIGN VS MALIGNANT

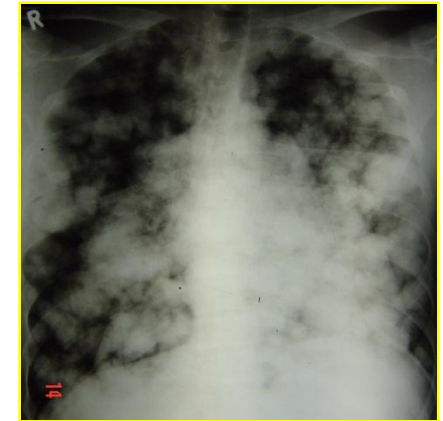


BIOPSY OF BONE TUMOURS

- ? Diagnosis , ? Stage
- Same surgeon as final procedure
- Biopsy tract location important
- Meticulous haemostasis
- Samples for micro & histo

OPEN BIOPSY

- **EXCISIONAL** : When possible in benign lesions
- **INCISIONAL** : Preferable in malignant lesion



PRINCIPLES

- Longitudinal incision
- Sharp dissection
- Limited anatomic exposure
- Avoid neurovascular exposure
- Sample reactive tissue, pseudo capsule, capsule, tumour
- Small bone window if necessary



PRINCIPLES (CONT)

- Haemostasis
- Subcutaneous stitch
- Drain in line with incision
- If procedure follows biopsy

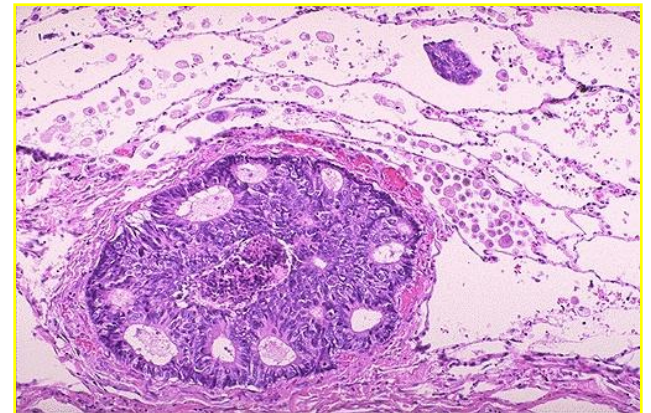
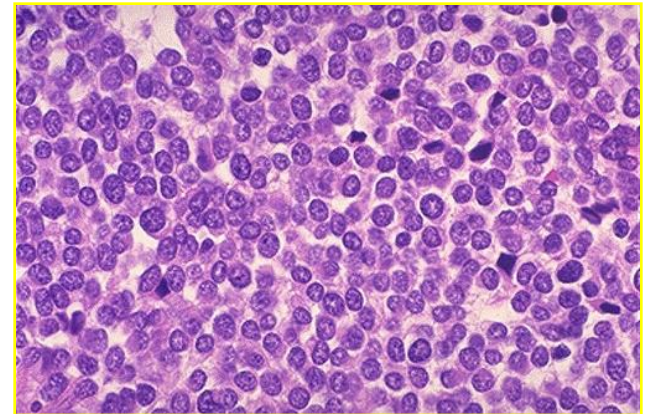
→ new instruments and drapes

NEEDLE BIOPSY

- As for open biopsy
- Biopsy tract where can be excised
- Fine needle biopsy
- Core needle biopsy
- Disadvantage = tissue biopsy possibility being non-representative (eg. Necrosis or reactive)

FROZEN SECTION

- Determine if specimen adequate or reactive
- Lesion inflammatory/ needs mcs ?
- Need for further investigations ?
- Immediate diagnosis possible



SURGICAL PROCEDURES



GOAL

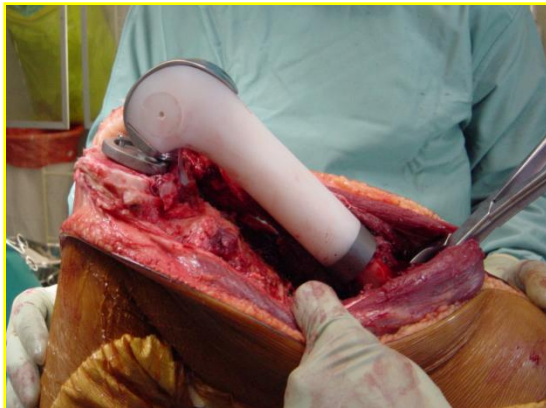
REMOVE LESION WITH
MINIMAL RISK OF LOCAL
RECURRENCE



LIMB SALVAGE

- **CRITERIA :**

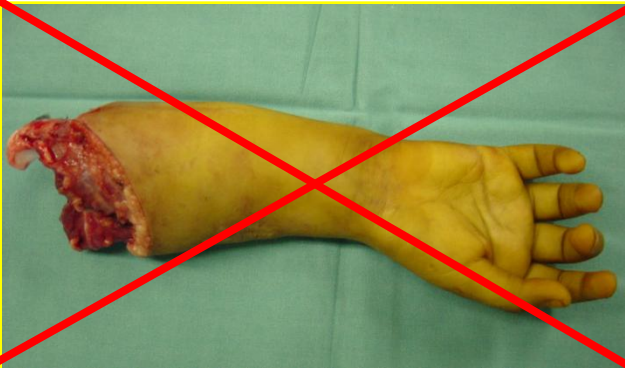
- 1. Local control = amputation**
- 2. Saved limb must be functional**



LIMB SALVAGE

- VARIOUS METHODS:

1. Endoprosthesis
2. Allograft
3. Composite
4. Arthrodesis

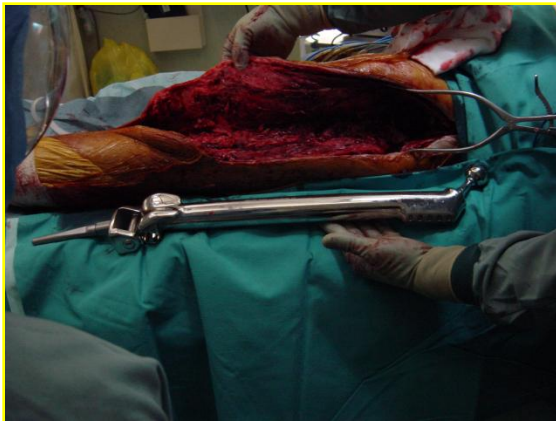


LIMB SALVAGE



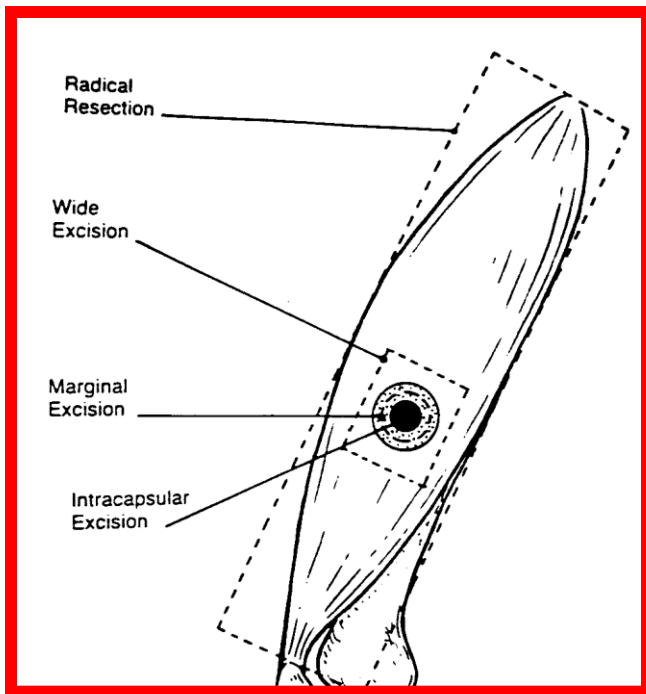
- Contra – indications:

1. Pathological fractures
2. Skeletal immaturity
3. Anatomical site



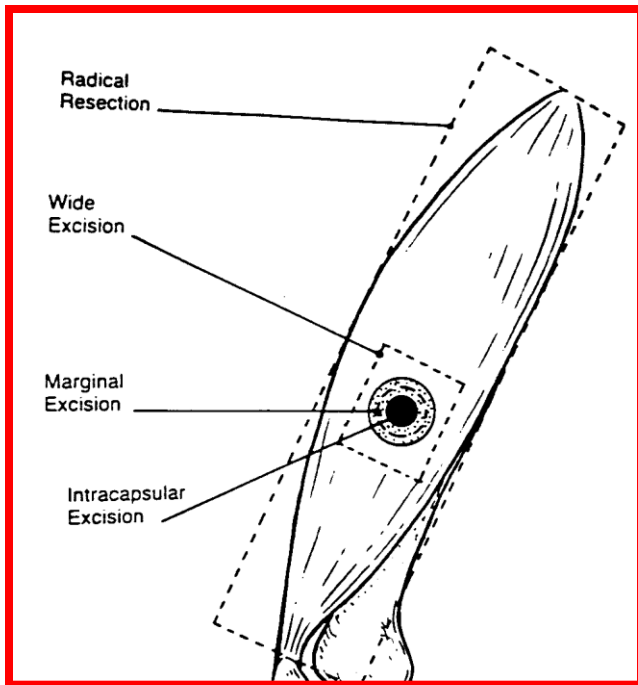
Distant metastases is
not a
Contra-indication

SURGICAL MARGINS



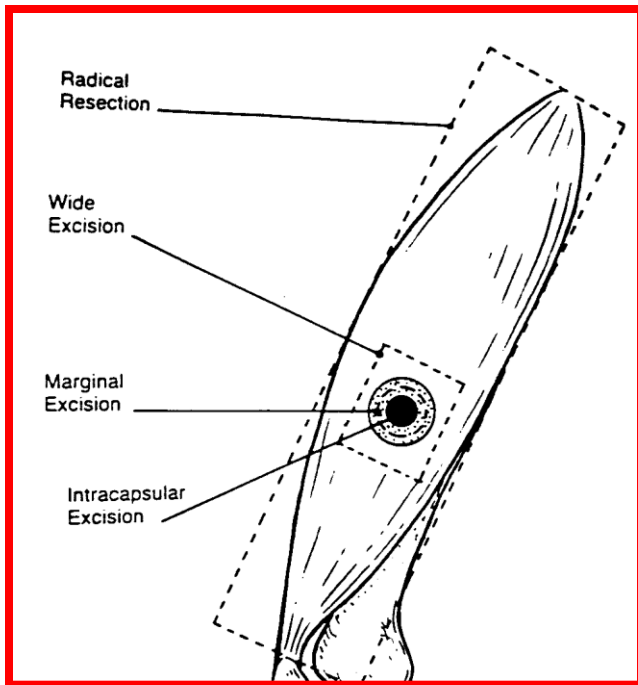
1. INTRA-LESIONAL
2. MARGINAL
3. WIDE
4. RADICAL
5. AMPUTATION

INTRA-LESIONAL



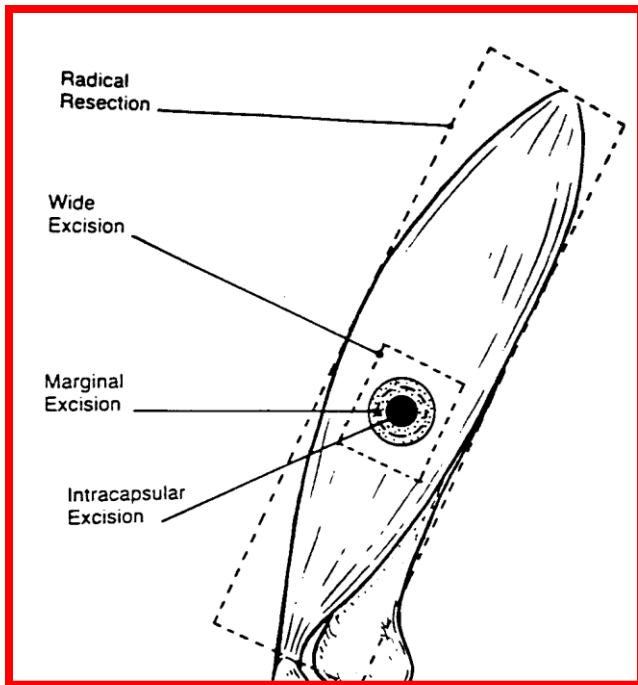
- Dissection passes through the tumour
- Leaves macroscopic tumour
- Not therapeutic

MARGINAL



- Through pseudo-capsule of tumour / reactive zone
- Controls non-invasive benign tumours
- Recurrence in malignant lesions = 25-50%

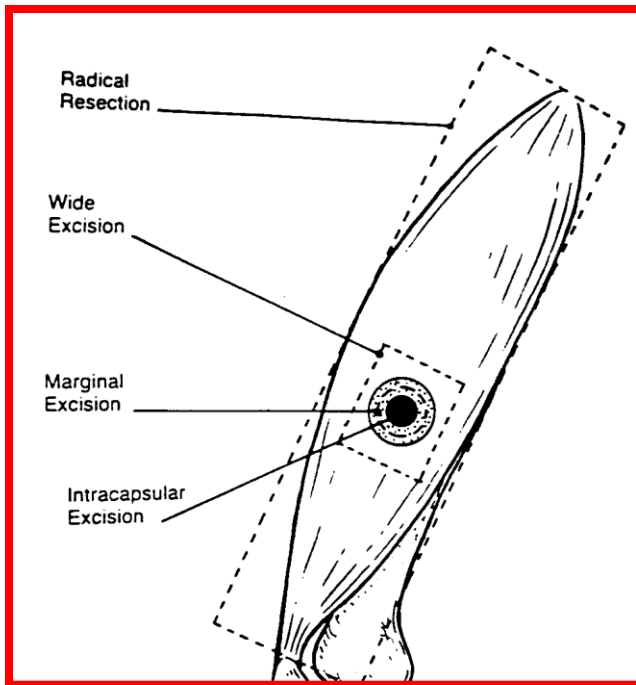
WIDE



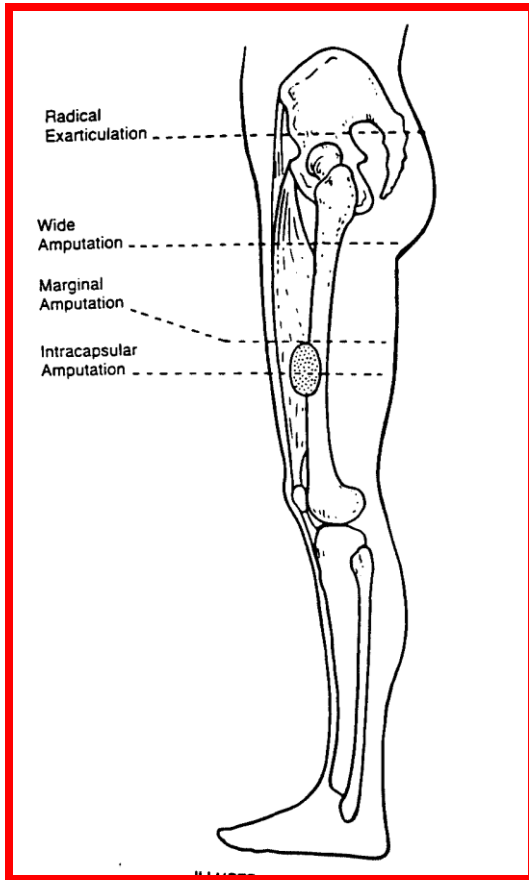
- Dissection entirely through normal tissue at a distance from the lesion
- Skip lesions / microscopic satellites may be left
- Recurrence of malignant lesions = < 10%

RADICAL

- Removal of entire compartment
- Distant metastases left



AMPUTATION



- Intra-capsular
- Marginal
- Wide
- Radical

ADJUVANT CHEMOTHERAPY

- Reduces mass and vascularity of tumour
- Time for operative planning
- Want 90% kill rate
- Localized disease = 60-70% long-term disease free survival

COMPLICATIONS

- Stunting of growth
- Osteoporosis
- AVN
- Cisplatinum → nephro & oto toxicity
- Adriamycin → Cardiotoxic
- Vincristine → Neurotoxicity
- Chemotherapeutic induced malignancy usually blood forming , eg Leukaemias

RADIOTHERAPY

- Absorption by complex molecules → rupture of chemical bonds
- Indirect → DNA changes → stop cell reproduction & specific cell Fx
- Destruction of small blood vessels
- Radiosensitivity = mitotic activity

x= degree differentiation

ADVERSE EFFECTS

- Joint stiffness / function loss
- Subcutaneous fibrosis
- Premature growthplate closure
- Irradiation induced sarcoma
- Enteritis, diarrhoea, obstruction and bleeding
- Cystitis and hepatitis

ADVERSE EFFECTS

- Muscle atrophy and fibrosis
- Erythema and hyperpigmentation
- Hair loss and skin flaking
- Lymphoedema

DEFINITIONS

- **Rad** (radiation absorbed dose) = Energy imparted to matter by ionising radiation per unit mass
- **Grays** (Gr) = 1 Joule of energy absorbed by a mass of 1 kg